A Meteor and the Weather in New Caledonia

ACCORDING to my promise to send you accounts of any remarkable meteors that I may see here, I now notify one which appeared yesterday evening, April 13, at 20 minutes past 6 P.M. We were driving slowly home from Ansevata, near Noumea, when a splendid brilliant *pure white* meteor fell from the zenith, about 30°, quite perpendicularly and slowly. It burst into three pieces, and instantly disappeared. From Noumea its direction was due south, and in size it appeared four or five times larger than Venus. We heard no noise; the sound of the carriage wheels grinding on the road would have prevented any but a rather loud one being audible. It was not dark, but twilight.

We have been suffering much from unusual heat, and the atmosphere is surcharged with electricity. Heavy storms brew in the mountains, but we have been free from them here in Noumea. Heavy rain squalls gather to the southward, and on reaching the south point of New Caledonia either divide and run along the mountains on one side or the circling reef on the other, or also pass solidly in either direction, leaving the peninsula of Noumea perfectly dry. E. L. LAYARD

Brit. Consulate, Noumea, April 14

Intellect in Brutes

MR. ROMANES has alluded to some of the peculiarities of my feline pets, but really those are by no means the most striking instances of their intelligence. My wife and I are devotedly fond of our cats, so much so as to afford amusement to our friends, and we are never tired of expatiating on their indications of intelligence. A pedigree book is kept, and any reader of NATURE desirous of possessing a kitten of an intelligent stock is welcome to one on three or four months' notice.

I wish to give one other story of them which seems to show that they are apt to indulge in revenge and to act in systematic co-operation to accomplish it. They are of very cleanly habits, and, save under the circumstances about to be narrated, have never given any trouble in this respect. But some time ago we had a visitor who had a strong and very badly-concealed dislike to them. The dislike was quite mutual. Very soon after the arrival of this visitor the cats became very objectionable on account of messes, and these were concentrated in and near the bedroom occupied by the object of their aversion. Their insanitary proceedings became so pronounced that it almost appeared as if they had invited all their feline friends in the neighbourhood to join in the establishment of a "night-soil tip." No amount of correction, aided by pepper of the most pungent kind, could stop it, and I most reluctantly determined upon a wholesale felicide. The visitor departed, however, before this was carried into effect, and immediately the nuisance ceased, and our cats resumed their original cleanly habits.

LAWSON TAIT

I HAVE perused with interest the admirable summary of the "Animal Intelligence" question by Mr. Romanes. On reading the article in question, it occurred to me that I had at hand some memoranda concerning animal intelligence which bear on the presence, not merely of *abstract* reasoning in dogs, but also upon the presence in dogs of traits of character remarkably resembling those we are accustomed to name "retaliation" and "revenge" in man. I now send you the jottings in question, obtained, I may add, from personal friends. About thirteen years ago, a now deceased medical man residing near Edinburgh, possessed a favourite collie, "Cheviot" by name. The incident I am about to relate, I may mention, was related to me by the son of the gentleman in question, both father and son, along with a perfectly disinterested party, having corroborated the facts. The then provost of the burgh in which "Cheviot" resided, had issued an interdict against unmuzzled dogs during the "dog days," and "Cheviot" submitted with no good grace to the operation of securing his jaws. Frequently "Cheviot's" master and the members of the family spoke in the dog's hearing, in no measured terms of the cruelty of the provost's order. But the end of the "dog days" came, and "Cheviot's" muzzle was removed. On the afternoon of the day of liberation, the provost called on "Cheviot's" master, to say, that in the morning he had heard a dog whining at his front door. The provost opened the door; "Cheviot" was in waiting, his muzzle in his mouth. One look at the provost, and the muzzle was dropped at his feet, "Cheviot" scampering off in the highest glee, as if delighted to have had the opportunity of laying the cause of his grievance at the door of his enemy.

The details were vouched for by the provost himself, also a medical practitioner in the burgh.

Here it seems to me you possess an incident of dog character explicable only on the supposition that there are germs in the canine philosophy of acts and traits fully developed in ours.

Incident number two deals with the doings of a retriever, some four or five years old, who, whilst bearing an implacable enmity to felines at large, had struck up a close friendship with a household cat, which, from kittenhood, had been associated with him. For sanitary reasons the cat was condemned to die. According to the orthodox method, puss was placed in a sack weighted with stones, and carried to the sea, "Keeper," the dog, following in the wake of the procession. The cat was duly thrown into the sea, "Keeper" waited to see if it would rise, but on seeing no signs of his feline friend, he at once dived for the sack, and landed it at an adjacent pier. Being met by the executioners and divining that puss was yet in danger, "Keeper" re-entered the water, sack in mouth, and swam across the bay to a point of safety, and landed his burden. Puss was spared in deference to "Keeper's" anxiety.

I can find still another example of extreme unselfishness in a mongrel dog, who, for some years before the death of an old deaf and blind companion, was accustomed to proceed to his resting-place, and bark in his ear to warn him of the presence near at hand of the milk which the kindly hand of the mistress of the house was accustomed to place for the delectation of both. This proceeding was repeated day by day, with unvarying regularity, and in its nature suggests strongly that the exercise of self-denial—amidst the obvious temptation of an easy acquirement of luxury—has to be placed to the credit account of the canine race. ANDREW WILSON

Edinburgh Medical School, June 6

WITH reference to the article in NATURE of 5th June, permit me to narrate an instance of "abstract reasoning" in a retriever that I was witness to last autumn.

Having shot a hare so slightly as to make it a long chase for the dog (a young one), I watched the retriever follow the hare over the open hills of Aberdeenshire for upwards of two miles until the chase was lost to view under a stone dyke. In a few moments the dog was observed to carry something in his mouth with which he disappeared over the dyke into a turnip field. "He has killed the hare and he is too tired to bring it back, so he is burying it," quoth the keeper, "we shall come up with it in the evening." The day's sport over, we made for the dog's burying ground, but the retriever, if you please, knew nothing about it; and careered wildly about in every direction except the right one. The keeper, Henry Ledingham of Tarland, Aboyne, having a remarkable gift of spotting fallen game, actually put his foot on the very spot among the turnips where the burial had occurred. After immense affectation of surprise the retriever was forced to unearth the hare. The hare, however, was a rotten old carcass of a hare, with no eyes and teeth, that the retriever had picked up and buried to save himself the pains of following the live hare. Perfectly conscious of his misdeed, the dog had given evidence of abstract reasoning in each stage of the transaction.

CHARLES BAILLIE HAMILTON

St. Stephen's Club, Westminster, June 10

I HAVE followed the discussion in your columns on "Intellect in Brutes" attentively, and I maintain that Mr. Henslow's distinction between man's power of abstract reasoning, and the reasoning of animals from objects present to the senses (a faculty they certainly possess, if the theory of deductive reasoning, that all inference is from particulars to particulars be accepted, which, however, cannot be proved), is perfectly valid, in spite of any accidental errors of illustration.

The fact that a cat or a dog subject their food to examination before eating it, does not most assuredly prove the possession of abstract powers of thought in the animal. Mr. Romanes here says:—"The motive of the examination being to ascertain which general idea of quality is appropriate to the particular object examined."

Here he attributes to an animal whose nature he does not fully understand his own process of thought, and this appears to me to be a constant source of error in the investigation of animal psychology. That brutes possess self-consciousness, introspection, imagination, abstract thought, cannot, I think, be proved. The

fact that animals possess faculties differing from those of man is an insuperable obstacle to a perfect analysis of their intelligences.

Name these faculties as you please, call them "inherited habit," "inherited memory," it is perfectly certain that man does not possess them. H. D. BARCLAY

WILLIAM FROUDE

THE death of Mr. W. Froude, F.R.S., is a loss to science that cannot well be estimated. For many years he laboured with great ability and success in a field of research that was beset with difficulties, and had previously been almost barren of results. He was educated at Westminster, and went from there to Oxford, where he distinguished himself in mathematics. After leaving Oxford he became a civil engineer, and assisted Mr. Brunel in railway and other engineering work. He retired from active professional life in 1846, but his love of applied science retained such a hold upon him that he never ceased to occupy himself with important scientific investigations, and the solution of practical problems of peculiar difficulty. His intimacy with Mr. Brunel led to his mind being directed towards the study of those laws of nature which govern the motion of floating bodies. Mr. Brunel had devoted himself, among other things, to the improvement and development of iron steamship construction. In the *Great Western* and *Great Britain* he had made great advances in this direction; while in the *Great Eastern* he showed that iron and steam power could be employed in the production of ships of practically unlimited dimensions, and that by means of these agencies all the advantages appertaining to increased size might be realised.

In designing ships of such exceptional character and dimensions, Mr. Brunel found little to guide him in judging of their behaviour at sea. They were so different to any vessels afloat whose behaviour and qualities might have been ascertained, that he was unable to appeal to experience, while the light of science was so feeble and doubtful as to afford him no aid. Nobody at that time knew anything of the laws upon which a ship's motion at sea depends. There was a large mass of traditional experience, but this was often at variance with fact, owing to phenomena which are familiar to seamen being regarded as absolute, and possessing a reality of existence as well as of appearance; while, as must be obvious, they are only relative in their character, and cannot be accurately defined without making due allowance for the position and motion of a ship, with reference to the sea. The rules and maxims that had been adopted upon such incorrect and distorted data, were either unimportant or misleading; they were of no value. Mr. Froude said, quite correctly, in 1861, that our shipbuilders, while extending their knowledge in other directions, seem to have guided themselves by rhetorical phrases or random speculations in this particular branch of their art, "so that when a new ship is sent to sea, her constructor has to watch her behaviour in a seaway, with as anxious and uncertain an eye as if she were an animal he had bred and was rearing, and hoped would turn out well, not a work which he had himself completed, and whose performance he could predict, in virtue of the principles he had acted on in its design."

Mr. Froude, at the request of Mr. Brunel, commenced in 1856 an investigation into the laws of motion of a ship among waves. This had been previously attempted by D. Bernouilli, Euler, Moseley, and others, but without success. None of these writers had realised the fundamental conditions of the action of wave-water upon a ship, viz., that the direction and intensity of the fluid-pressure at any point is continually changing, and that the direction of pressure is normal to the surface of equal pressure passing through that point. They based their theories upon hypotheses respecting wave-action that were all more or less erroneous, and prevented any useful result being realised. Mr. Froude's method of dealing with the subject was, first of all, to determine the manner in which a wave acts upon a ship; or, in other words, the mode of operation of the agency whose effects he wished to comprehend. In this he was completely successful, and proved in an unexceptionable manner the mechanical possibility of that form of motion known as the trochoidal sea-wave. On the assumption that the motion of each particle on the surface of a wave describes an exact circle, whose diameter is the height of the wave from hollow to crest—which agrees with the results of observation—and that the motions of all particles lie in vertical planes which cut the wave-ridges at right angles, he deduced the theory that the form of the wave would be trochoidal, and that the periodic time would be equal to the time occupied by a heavy body in falling through a height equal to the circumference of a circle whose diameter is the length of a wave. It also followed that all sub-surfaces of equal pressure would be trochoids of the same length as the surface-wave, but of a height which would diminish with the depth in accordance with the equation $\frac{r_o}{r_d} = e^{\frac{\pi}{L}d}$, where e is the base of Napierian logarithms, L the length of the wave from hollow to crest, d the depth of the centre of the circle described by any particle below that of the circle described by the surface-particle, r_d the radius of the circle at the depth d, and r_o that of the circle at the surface. Prof. Rankine also independently deduced the same theory. A striking feature of the investigation was the rapid decrease in the motions of the particles as they are traced to lower depths. Prof. Stokes showed that for all waves of ordinary proportions, the motion at a depth equal to the length of the whole wave from crest to crest is only $\frac{1}{535}$ of that which belongs to a surface particle. The dynamical conditions of wave-water being thoroughly investigated and established, Mr. Froude next proceeded to base upon it a scientific theory of the rolling of ships among waves.

The subject was first brought before the public by Mr. Froude in a paper read before the Institution of Naval Architects in 1861. He stated that he felt some diffidence in bringing forward "what assumes to be a tolerably complete theoretical elucidation of a difficult and intricate subject, which has hitherto been treated as if unapproachable by the methods of regular investigation." He pointed out that the characteristic feature of the dynamical laws to which it would be necessary to refer the movements of a ship when rolling is the gradual accumulation of angle during several successive rolls, the cumulative action thus growing up into a maximum, and then dying out by very similar gradations until the ship becomes for a moment steady, when a nearly similar series of excursions commences and is reproduced; while in reference to the momentary pause, or cessation of motion, it seems clear that it occurs, not because the waves themselves cease, or cease to act, but because the last oscillation has died out at a moment when the ship and the waves have come to occupy, relatively, a position of momentary equilibrium. This is so closely analogous to what happens when a pendulum is subjected to a series of impulses, partially synchronous with its own excursions, that it seemed probable that the laws which govern the latter class of phenomena would be found, *mutatis mutandis*, applicable to the elucidation of the former also. The investigation of the laws of rolling motion, when thus regarded, therefore assumed the form of the inquiry, "What is the cumulative result of the continuous action of a series of consecutive waves operating on a given ship?"

In order to determine this it was necessary first to determine how each individual wave will act upon a ship at each instant of time; or, in other words, "What is the position of momentary equilibrium for a body floating on a wave, and what accelerating force towards that position